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A Functional Study of Lithics from Vænget Nord, a Mesolithic Site at Vedbæk, N.E. Sjælland

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Since 1975 the so-called Vedbæk-project has been in operation with the aim of describing and explaining the changes observable in the behaviour of a Mesolithic (and early Neolithic) population around a Zealandic fjord during the Atlantic and early Subboreal periods, app. 5.500 to 2.500 bc (Brinch Petersen *et al.* 1976).

A first step forward was the investigation in 1975 of the Mesolithic cemetery at Henriksholm-Bøgebakken (Albrethsen and Brinch Petersen 1977). During the following years a number of sites were excavated in the bog as well as under the town (Vang Petersen 1982). Meanwhile, the recovered faunal material from the excavations were recorded and analysed, and a general picture of faunal diversity emerged (Aaris-Sørensen 1980a, 1980b, 1982a, 1982b, 1983; Enghoff 1983). Likewise, profitting from the many cuttings in the bog as well as from a great number of C14 dates, a local shore displacement curve has been worked out for the period in question (Christensen 1982a, 1982b). Furthermore, this curve has been tied in with the Mesolithic chronology as put forward recently (Vang Petersen 1984).

VÆNGET NORD

Another important step forward within the project has been the discovery and subsequent excavation of the Mesolithic site at Vænget Nord. The site was discovered by chance in 1976, tested in 1977 and then excavated in 1980, '82, and '83. As a result of the testing it became evident, that the site was situated on a small island just outside the southern bank of the original fjord. Actually, the exact location is only 150 meters to the west of "Vedbæk Boldbaner", excavated by the National Museum in the forties (Mathiassen 1946).

The material recovered from the testpits indicated, as did the first C14 dates, an occupation around 5.000 bc, thus making it one of the oldest known Mesolithic sites in the area (Vang Petersen 1984). Furthermore, not only was the site intact, a rare case in Vedbæk, but as the top of the island attained a maximum height of only 2,75 m a.s.l. the Littorina transgression around 4.800 bc made an end to the habitation, and the ongoing transgression sealed of the site completely (Christensen 1982a). Therefore, it became tempting to undertake a total excavation of that particular site, and today a little more than 500 m^2 have been excavated with various strategies. Despite the attempt there are never the less still areas reserved for a future investigation (fig. 1).

Over the central part of the island, some 226 m^2 were exposed during a horizontal *décapage*, with all the backdirt being watersieved and sorted out per quarter square metre. Most of the lithics studied in the present paper originate from this exposure (fig. 2).

Due to the horizontal exposure of the central part of the island, it has been possible to locate and excavate a number of anthropogenic features (fig. 1). These can tentatively be described as simple hearths, charcoal patches (*vidange*), cooking pits, dumps of fire-cracked stones, and some, until now, unspecified pits. Also a paved stone platform was noticed. Furthermore, in one pit was found a flint cache while another has been interpreted as a burial pit. Wooden posts were found on the fringe of the island, while more than 200 stakeholes were discovered on the top of the island during the last field season, and it is highly possible, that an even greater number was missed during the earlier seasons. However, neither the posts, nor the stakeholes can be said to form evident structures (Brinch Petersen in press).

Unfortunately, faunal remains were not preserved on the top of the island, and bones were only recovered in some quantity in the saturated part in front of the site. However, despite the limited number of bones, Vænget Nord shows the same mixture of marine and sylvan spe-

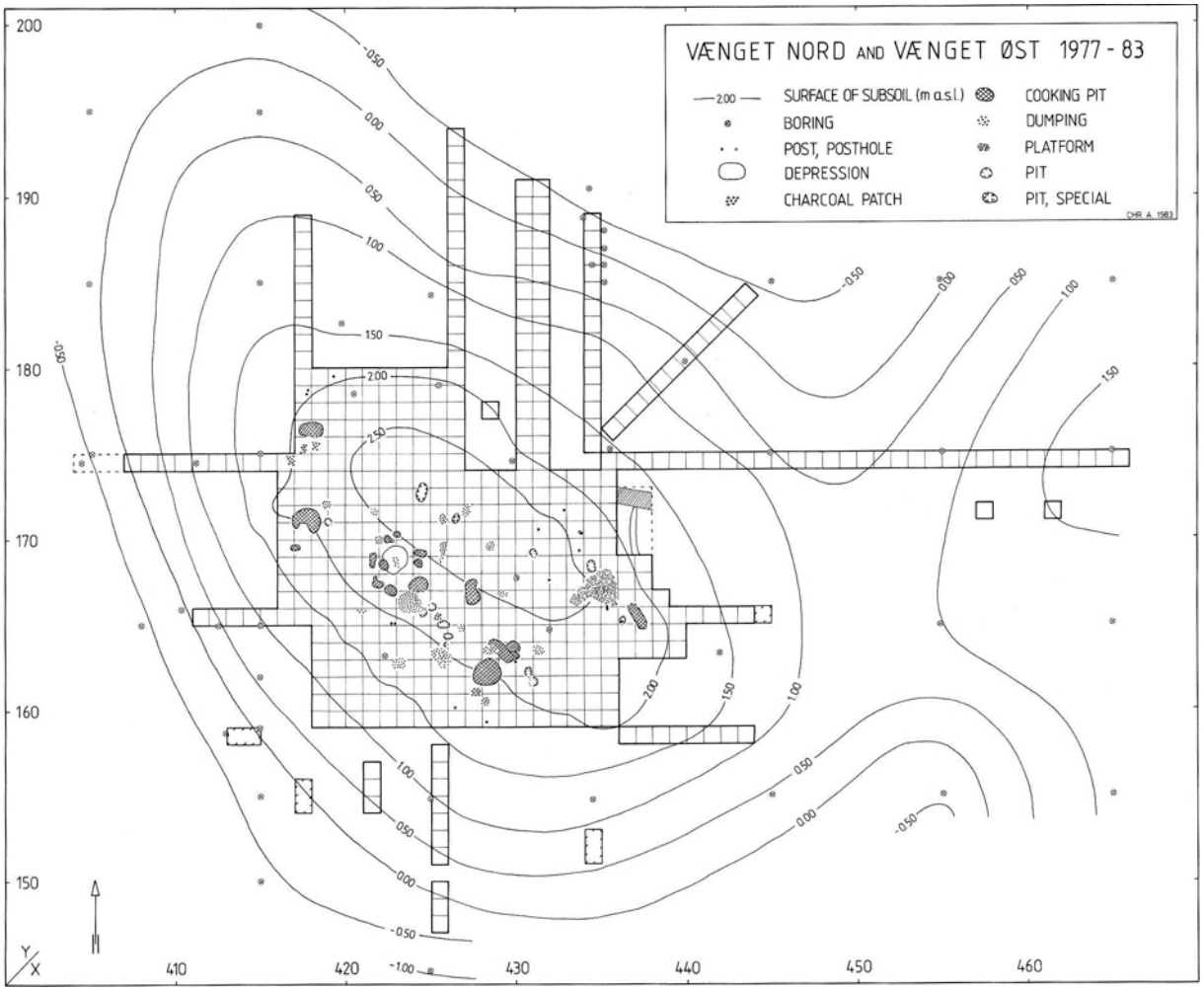

Fig. 1. Vænget Nord, excavation plan (Chr. Adamsen *del.*).

cies as is known from the other sites (Aaris-Sørensen 1982b). In order to indicate the range of possibilities when interpreting the results of the wear analysis, a list of the identified species from Vænget Nord is given below (Aaris-Sørensen *in litteris* and excavation report).

Pisces:	**Fish:**
Anguilla anguilla (L.)	Eel
Belone belone (L.)	Garfish
Esox lucius L.	Pike
Gadus morhua L.	Cod
Gadidae	
Pleuronectidae	
Raja clavata L.	Sting ray
Scomber scombrus L.	Mackerel
Squalus acanthias L.	Piked dogfish

Aves:	**Birds:**
Anatidae	
Mammalia:	**Mammals:**
Capreolus capreolus (L.)	Roe deer
Castor fiber L.	Beaver
Cervus elaphus L.	Red deer
Halichoerus grypus (Fabricius)	Grey seal
Homo sapiens L.	Man
Martes martes (L.)	Pine marten
Sus scrofa L.	Wild boar

Finally, it must be stated, that the two wooden objects found on the site, a dugout canoe and an elmbow, are both younger than the main occupation, which due to poor preservation conditions were devoid of such finds.

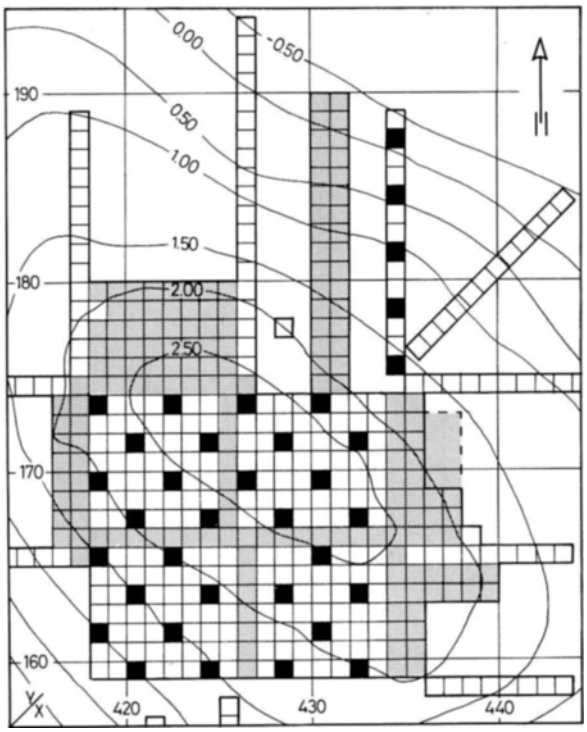

Fig. 2. Vænget Nord, location of sampled squares (Chr. Adamsen *del.*).

USE WEAR ANALYSIS

The present study summarises the results of a functional investigation of lithics from Vænget Nord. Material discussed in this paper was uncovered during the first two field seasons of excavation (1980 and 1982) while flints from the final field season are not considered here (fig. 2). At the time of this writing a second stage of wear analysis has been initiated. Likewise the general analyses of the site and the final excavation report are still in progress. Because of this the following report must be considered partly preliminary. However, it may be reasonably supposed that the material studied so far is representative of the excavated area, of the total number of stone tools recovered and of the variations exhibited in the lithic assemblage.

OBJECTIVES AND SAMPLING

The main objectives for the analysis were two-fold, namely

1) to get an idea about the function of the site by examining a cross-section of the lithic component, and
2) to investigate if only retouched tools and some of the blades had been used or if "hidden tools" could be detected even further down the "debitage hierachy" (*i.e.* flakes).

Since a serious lithic use wear study is time consuming, a functional analysis of the entire collection was precluded. Within the given time frame one could realistically expect to examine about 600 to 800 pieces of flint and the amount of square meters to be sampled was calculated on the basis of these numbers. Lay out of the selected square meters was determined by the wish to get as much as possible of the central area represented in this sample. Based on these considerations the analysis came to include pieces from $35m^2$, covering $5m^2$ in the northeastern trench and $30m^2$ distributed over the central excavation area (fig. 2).

For 17 of the sampled square meters the investigation included all worked, unpatinated and unburned flints larger than 3 cm. From the remaining $16m^2$ (all situated in the western half of the area) only blades, retouched tools and their by-products have been examined. Furthermore, since the number of retouched implements was fairly limited, it was decided to study *all* such tools found in the *décapage* areas.

METHOD OF ANALYSIS

The wear study follows the method and observations presented by L. Keeley (1980, Keeley and Newcomer 1977), P. Anderson-Gerfaud (1981) and E. Moss (1983). Basis for the functional assessments consists of several hundred experiments, executed before and during the investigation. The analyses were carried out by means of a reflected light microscope, type Olympus BHM, at magnifications between 100 and 400 diameters. Before inspection the flints were cleaned in a weak solution of NaOH and/or in luke-warm detergent water. All analysed pieces were drawn on data sheets with indications of the exact location of polishes. The natural state of the flint surfaces were registrered according to a gradient scale and various measures were recorded such as length, width, thickness and edge angle. A substantial number of micrographs were taken in order to document typical and unusual examples of the entire range of patterns of use and non-use wear traces.

RESULTS OF ANALYSIS (Table 1)

Retouched tools and their by-products

The number of retouched pieces at Vænget Nord is limited as is the range of morphologically distinctive types. The inventory is dominated by projectile points, core-axes and burins while scrapers are fairly rare. As retouched tools were few it was decided to include as many as possible in the analysis, not only from the selected square meters but from the entire central area. Not all core-axes and points were examined as their function was considered reasonably established so that time would be put into better use analysing other categories of flint. Axes and points from the sampled square meters were, however, analysed for possible wear traces.

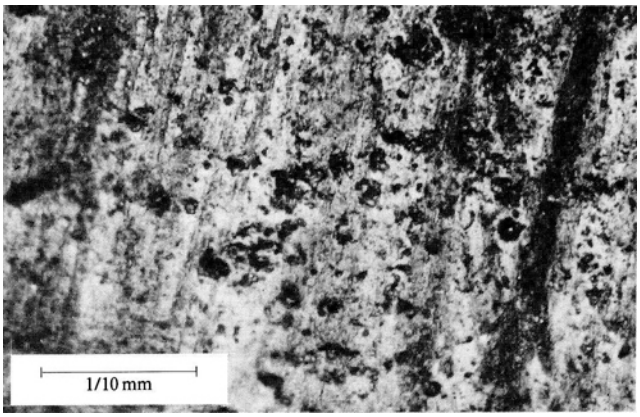

Fig. 3. Worn surface of core axe. Note the abraded surface and the deep linear striations.

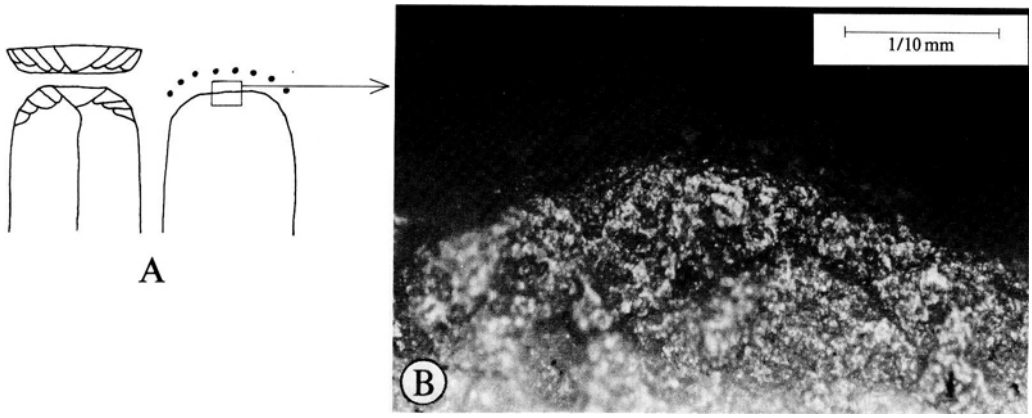

Fig. 4. A. Scematical presentation of scraper with broken edge. The dotted line indicates location of polish. – B. Light hide polish and rounding on edge of broken scraper.

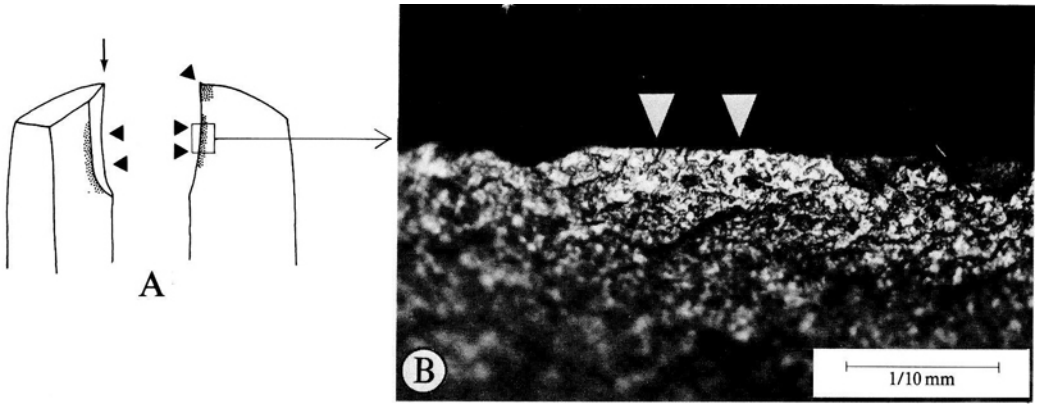

Fig. 5. A. Scematical presentation of polish location on burins. Arrows indicate direction of use. – B. Bone/antler polish on edge of burin facet (arrow).

Table 1.

MORPHOLOGICAL TYPES	NUMBER EXAMINED	NUMBER OF ANALYSABLE PIECES[a]	NUMBER OF PIECES WITH USE WEAR
Core axes	4	4	3
Rejuvenation flakes	9	8	4
Scrapers	11	10	9
Burins	34	26	23
Burin spalls	17	14	1
Truncated pieces	12	8	7
Projectile points	23	23	10
Microburins	11	11	0
Diverse retouched pieces[b]	59	37	19
Blades, unretouched	410	259	59
Flakes, unretouched	256	223	5
TOTAL	846	623	140

a) Some of the pieces originally considered for analysis were later excluded because of natural surface alterations which only showed up at the microscopic scale.
b) Categories not considered in the text.

The following section presents a *general* summary of patterns of edge utilisation displayed by the major retouched tool classes, while more detailed descriptions of individual variations in tool use must await the final site publication.

Core-axes and axe rejuvenation flakes: Four core-axes were analysed of which three yielded use traces. In only one instance was typical wood polish observed. Most of the edge wear occured in the shape of heavy abration and deep linear depressions, running perpendicular to the edge of the axes (fig. 3). Identical use patterns were found on four of the axe rejuvenation flakes, i.e. abration and heavy striations rather than polish formation. Most likely this *frictional* wear pattern is due to the violent nature of the axe blow.

One core-axe was unused (or resharpened and not reused). Aditionally four edge rejuvenation flakes examined displayed no traces of wear indicating that the flakes derived from the initial manufacture of the axes rather than from resharpening episodes.

Scrapers: The analysed scrapers had been used for hide processing (7 pieces), for wood working (one piece) and for the working of "hard material" (one piece). Apart from a single side scraper (used in the "hard material") most of the tools are endscrapers on short sections of blades. Six of these implements exhibit a somewhat puzzling pattern with respect to production as well as to use. All of the pieces are short, ranging from 1.7 to 3.9 cm in length. With the exception of one the working edge is retouched only along the outer corners while the section in between is constituted by a steep break running from the ventral to the dorsal aspect of the blank (fig. 4). These scrapers are all localised in the same area of the site and at least two of the implements fit together. The scraping edges show a lightly developed hide polish indicating very short use lifes. Taken together the observations *might* be explained as the results of unsuccessful attempts to make the implements work satisfactorily by breaking or snapping off the malfunctioning working edge and creating a fresh one simply by blunting away the pointed and probably damaging corners of the breaks.

So far only one heavily used scraper has been detected. The piece in question differs from the remaining scrapers by being produced on a big flake. Morphologically the implement must be classified as an endscraper, but the most important traces of wear as well as some deep striations were located on the ventral aspect of one of the unretouched lateral edges.

Burins: Typologically this group of tools consisted mainly of angled burins on breaks, most typically produced on heavy flakes or blades.

Twenty three burins exhibited use wear on one or several portions of the tool. The microwear traces attributable to function were interpreted as bone/antler

polish, unspecified hard material and a single instance of hide polish. The predominant material worked was bone/antler (20 pieces). Most burin tips or bevels showed traces of wear, although polish was often weakly developed. Frequently only one aspect of the bevel was used, either the ventral or dorsal broad side of the blank. However, use traces were not limited to the burin bevel as 18 of the tools were used to work bone or antler with the *sides* of the burin facets. In these instances polish was well developed, striations and polish direction indicating a scraping or shaving movement perpendicular to the edge (fig. 5). This particular mode of employment is not surprising. F. Bordes, among others, have illustrated the effectiveness of experimental burin sides for the finishing of surfaces of bone and antler (1965), and in archaeological contexts A. Leroi-Gourhan and M. Brezillon (1966) and P. Vaughan (1985) have demonstrated the edges of burin facets to be important functional units.

In addition to the burins 17 burin spalls were examined. Among these one displayed the same pattern of use found so frequently on the burins, i.e. the use of the facet edge for shaving or shaping bone/antler. The remaining 16 pieces showed no traces of wear.

Truncated blades and flakes: Seven truncated blades and flakes displayed traces of wear. In no instances did the truncated ends constitute an independent working edge. Rather, the retouch seem to have served mainly for producing a resistant point at the intersections of the truncations and the adjoining unretouched edges. Work polishes were found on both ventral and dorsal aspects of the points as well as along the sharp lateral sides of the blanks. Five pieces had been used for the cutting and scraping of hide and one for the cutting of siliceous plant material. The seventh utilised blade had worked hide as well as plant.

Projectile points: During the course of this study, a total of 23 rhomboid and oblique transverse points were analysed. None of these pieces showed actual work polishes indicating the nature of the target, but microscopic linear impact traces occurred on 10 of the points – parallel to the longitudinal axe of the pieces. The linear polishes were mainly located close to macroscopical fractures at the edge of the points. Most likely the microchips from the flint tips are responsible for the traces observed.

Table 2.

SITES	TOTAL	USED PIECES	%
Vænget Nord (VN)	259	59	23
Ageröd V (AG V)	76	43	57
Ringkloster (RKL)	63	46	73
Ertebølle (EB)	98	60	61

Frequencies of utilized blades

Absence of wear traces on the remaining 13 points do *not* necessarily indicate that these points were not used. Available experimental evidence demonstrate that only a proportion of fired arrow tips will yield diagnostic impact traces, depending for one thing on whether or not the projectile hit a hard substance such as bone or sinew (Barton and Bergman 1982, Moss and Newcomer 1983, Moss 1983, Fischer *et al.* 1984).

Unretouched pieces

Today it is widely acknowledged that retouched tools reflect only a small fraction of the activities going on at a site. Although retouched edges can be effective devices for the scraping, graving or chopping of harder or tougher materials as demonstrated in the previous section, a natural, sharp flint edge is the most logical choice for a number of other purposes. Thus ethnoarchaeological investigations of modern lithic industries have yielded numerous examples of the importance of unretouched tools (White and Thomas 1972, Gould 1977, Hayden 1977) and in recent years similar information begin to emerge from the archaeological record (Odell 1980, Moss 1983, Juel Jensen 1983 *inter alii*). Based on these considerations a total of 666 unretouched blades and flakes at Vænget Nord were selected for use wear examination, according to the sampling strategies outlined at the beginning of this paper.

Unretouched blades

Of the 259 analysable blades 59 (23%) displayed traces of wear. Because of differences in sampling procedures this figure is not strictly comparable to results from other south Scandinavian Mesolithic sites analysed by one of the authors (Table 2). As opposed to other samples, the Vænget Nord material includes all kinds of blades, i.e. microblades, broken pieces, small fragments. If regular, complete and almost complete blades are isolated, then the ratio between used an unused blades changes somewhat, although the frequency of

Table 3.

	Wood	Wood/ plant	Plant	Hide	Meat	Bone/ antler	Fish	Total No.
VN	13	4	21	39	23	–	–	56 (63)*
AG V	15	15	40	28	–	3	–	40 (43)*
RKL	30	–	17	17	15	17	–	47
EB	9	6	57	11	10	4	4	53 (63)*

* Polishes, which have not been identified, are not incorporated into the table. Thus 7 pieces at VN, 3 at AG V, and 10 pieces at EB are excluded.

Distribution of worked materials (%).

used blades is still below 40%. Furthermore, the Vænget Nord blades were sampled from a proper living area, that is, an area where flint knapping actually took place, resulting in the deposition of all sorts of debris. The other samples (Ageröd V, Ringkloster (Andersen 1975), Ertebølle) all come from shell midden or dump areas, that is, discrete and specialised areas within a site where material remains can be expected to exhibit greater proportions of tools in relation to debris. On these grounds the Vænget Nord material displayes a much lower and probably more realistic percentage of utilised blades in relation to the total population of blades at a site.

Edge angle and selection for use: Figure 6 represents edge angle values of the unretouched blades in terms of individual lateral edges (cortical edges being excluded). The figure sums up the relation between the number of utilised/non-utilised edges *and* the edge angle, measured in 10° intervals (Juel Jensen 1983, p. 152). A preference for lateral edges with edge angles between 30° and 55° appears quite clearly from the graph. Edges with values below and above this range are used more rarely. In gross this selective pattern is in accordance with patterns observed for other samples of blades (compare fig. 6 A with 6 B–D). Furthermore these angles correspond to the preferred range of cutting edges reported for unretouched flake tools from modern New Guinea and Australia (Gould, Koster and Sontz 1971, White and Thomas 1972, White 1977), thereby supporting the assumption that edge angles were selected according to simple utilitarian needs, i.e. they offered a sharp, but at the same time a sufficiently strong edge that would withstand the stresses of use.

Materials worked: The Vænget Nord blades were employed in the working of soft to medium hard materials like plant, hide, wood and meat in various proportions. The general orientation of polishes and the direction of striations indicate that the blades had been used in cutting, sawing, whittling and scraping movements. Table 3 presents the major patterns with respect to contact materials, and for the sake of comparison the table includes results from other Mesolithic blade samples.

This paper will concentrate on a discussion of the two numerically most important functions attributed to flint blades at Vænget Nord, namely the working of hide and of plant materials.

Hide working blades: The group of hide working blades constitute 22 pieces, or more than one third of the utilised blades. In terms of functional analysis "hide" is not a single worked material, as hide can be worked and processed in many different stages. So far, polishes caused by fresh, moist and dry hide can be distinguished from one another (Keeley 1980, Moss 1983) and at Vænget Nord all three variations were idenfied.

Five blades were used for the cutting of fresh hide, striations and direction of polishes indicating a longitudinal movement of the tools. Obviously in the case of fresh hide-cutting it cannot be estimated whether the polish developed directly from the skinning and dressing of game, or if some of the knives can be perceived as manufacturing tools, employed in the processing of furs.

The 17 blades used in the working of moist and dry hide turned out to be wielded in a variety of ways, alone or in combination. Most of the implements had been cutting hide, but on 15 pieces additional patterns of use were detected along sections of the edges. In at least 10 instances part of the unretouched edge had been used in transverse motions – probably for scraping activities as the edge rounding, polish built-up and striations were generally more pronounced on one aspect of the

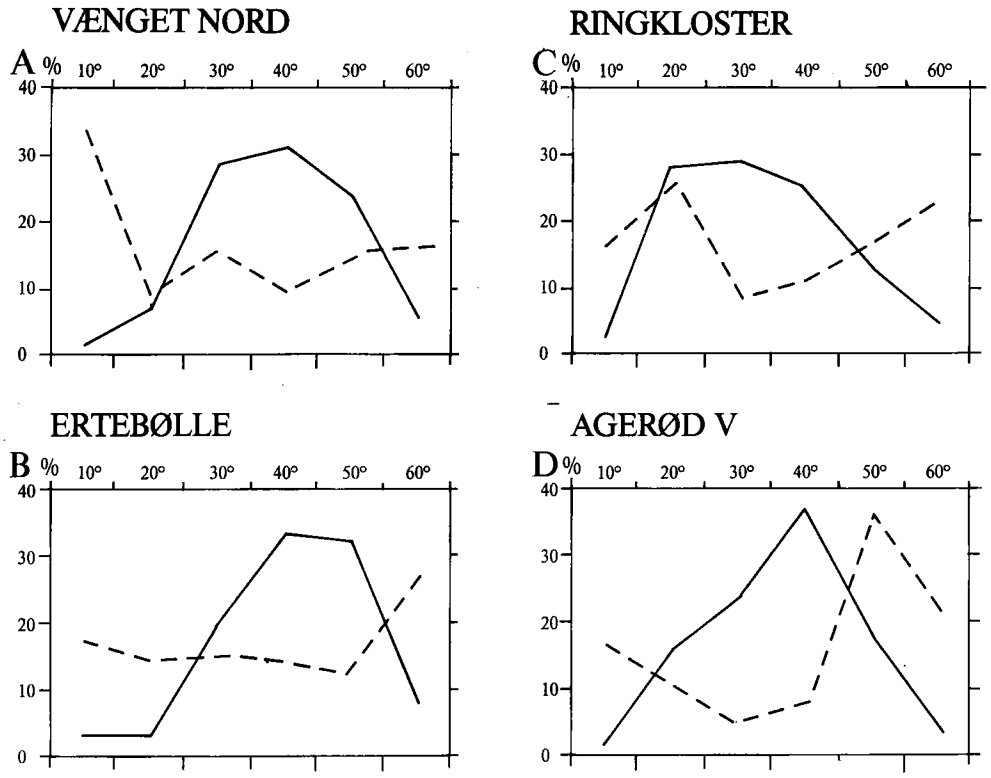

Fig. 6. Relative distribution of edge angles on blades. Full line: utilised edges. Broken line: unused edges.

edge (fig. 7). Furthermore it was noticed that several distal and proximal breaks had been used for the scraping of hide. Now, it is difficult to assess whether the hide scraping activities observed on the three different types of edges (unretouched edges, breaks, retouched scraper fronts) actually constitute *different* stages in the processing of hide, too subtle to be detected by wear analysis. Or, if the three kinds of edges were used interchangeably for the same tasks, i.e. the softening and currying part of the hide preparation.

Plant working blades: The plant working blades studied display a bright and shiny polish that is normally developed by the working of highly siliceous plant materials (Whitthoft 1967, Anderson 1980 *inter alii*). One of us (HJJ) has suggested elsewhere that most of the plant working knives found at Mesolithic and some of the early Neolithic sites are probably *manufacturing* tools rather than subsistence related implements used for the gathering of vegetable resources (Madsen and Juel Jensen 1982, Juel Jensen in prep). This proposition is in part substantiated by the structure of the polishes in relation to the working edges. In many instances the direction of the polish, as well as that of the striations are oriented perpendicular to the edge. The striations and the most heavily developed wear are found on the ventral surface of the tools which must therefore have constituted the leading side. In most cases the polish is restricted to a short section along the edge line – between 0.5 and 2 cm. It is reasonable to assume that these measures constitute the width of the material worked, and that the edges were used for the splitting and shaving of single plant stems, possibly for the use in the making of baskets or the like. This particular pattern, previously documented at the Kongemose site of Ageröd V, Scania (Larsson 1983), at the final Mesolithic site of Ertebølle, Jutland (Madsen *et al.* 1900, Andersen and Johansen 1983) and the early Neolithic site of Mosegården, Jutland (Madsen and Juel Jensen 1982), has been observed on seven of the 12 plant working blades at Vænget Nord (fig. 8).

Unretouched flakes

The functional analysis of lithic material from Vænget Nord included not only retouched tools and blades but also a substantial number of flakes. A total of 256 flakes were analysed, from the 5m^2 in the trench as well as

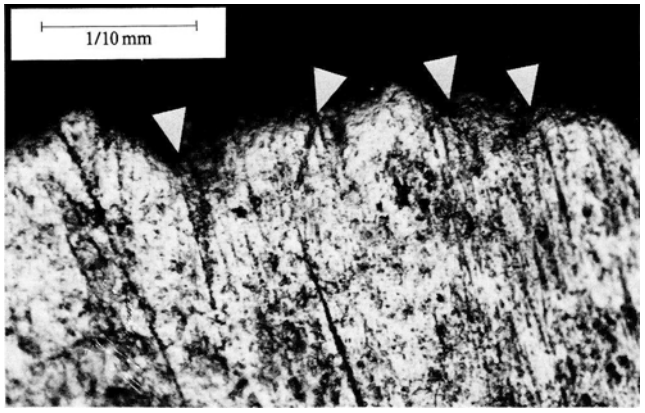

Fig. 7. Unretouched edge used for scraping dry hide. Linear striations (arrows) indicate direction of use.

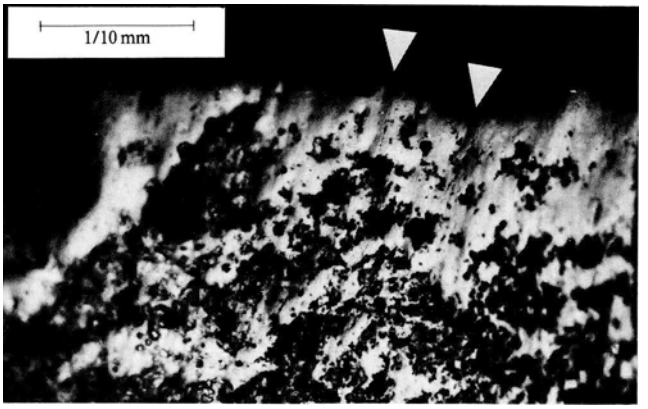

Fig. 8. Unretouched edge used for plant working (ventral aspect). Note the bright and reflective surface and the striations, that indicate the direction of use (arrow).

from the two eastern main sections of the excavation ($14m^2$). At this point the analysis was stopped; of all the flakes examined so far only five displayed traces of wear. At this site at least, it seems that flakes were neither produced nor perceived as potential tools; rather they were simply the debris – or by-products – of the lithic reduction sequence, in particular from the production of core-axes.

By measuring the lateral edge angles it becomes evident that the main body of flakes display edge angle values that are marginal in relation to the range of "optimal edge angles" demonstrated for the blade sample, that is, flake edges are either too thin or too steep to be effective devices for use (compare fig. 9 with fig. 6).

CONCLUDING REMARKS ON FUNCTION

Important activites at the site of Vænget Nord are bone/antler working (represented by the burins), and the working of hide in different stages. Also, the number of meat- and butchering knives are fairly large (Table 3) considering the subtleness of meat polish. These particular functions can be classified as parts of the same activity "complex", i.e. the butchering of animals and the processing of raw materials from these. The many projectile points are part of this complex, too.

Evidently the dominating role played by hide has made little impact on the retouched tool categories, since scrapers, as mentioned earlier, are fairly rare. The relative absence of classical, retouched scrapers is typi-

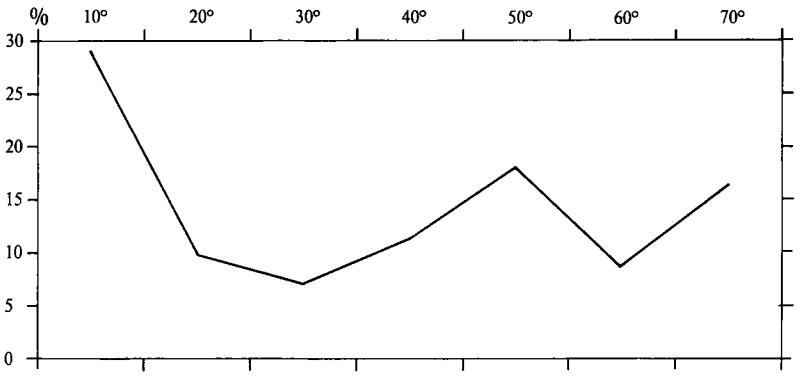

Fig. 9. Relative distribution of edge angle values on flakes (357 non-cortical edges).

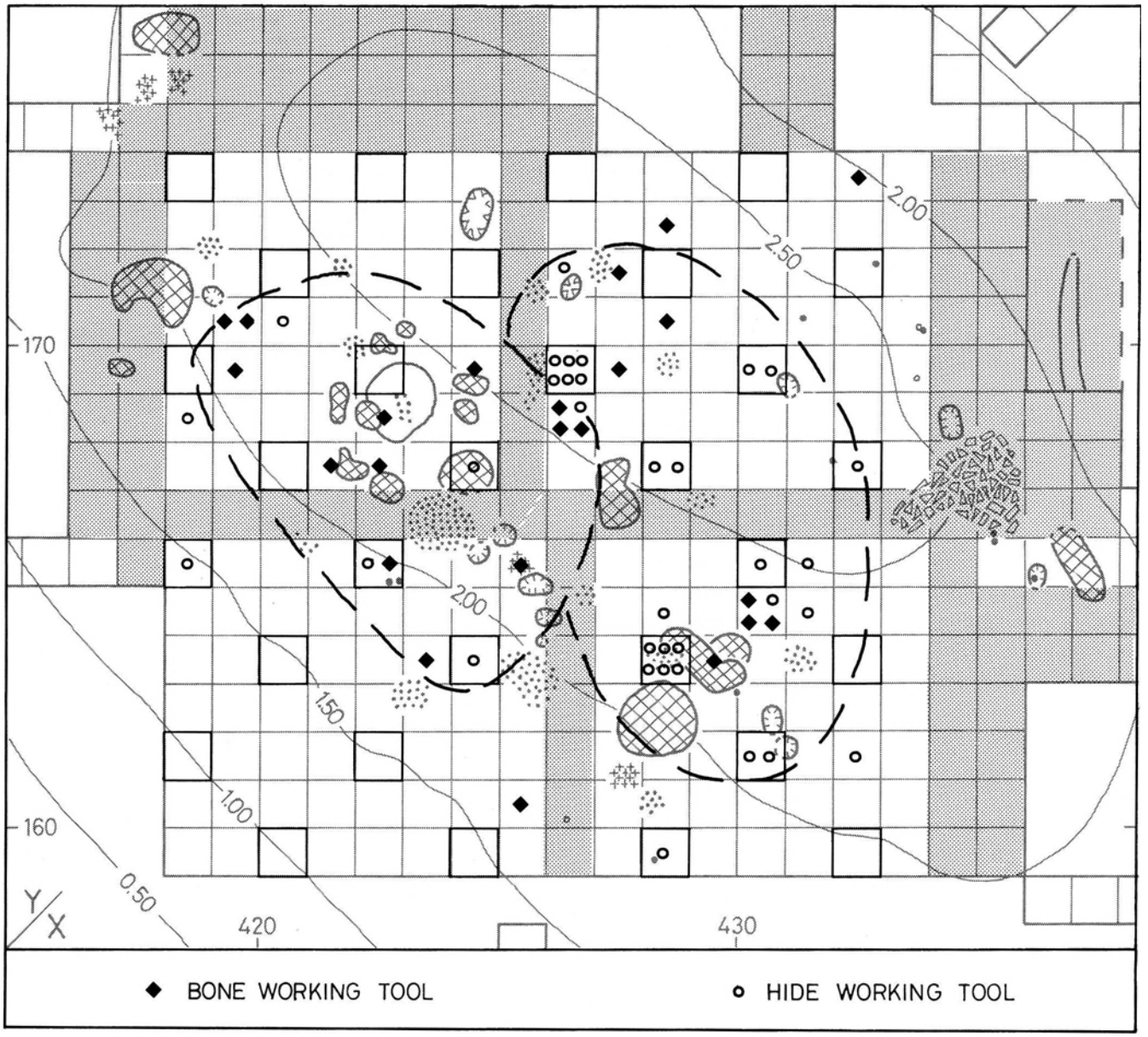

Fig. 10. Distribution of bone/antler working tools as opposed to hide working tools in the central part of the excavation (Chr. Adamsen *del.*).

cal not only for Vænget Nord, but for all East Danish sites from the Kongemosian and the early Ertebølle Culture (Vang Petersen 1984). Several factors might be responsible for this situation: (a) hide working procedures (*i.e.* the currying face) changed from the Maglemosian to the Kongemose period; (b) the softening part of the hide preparation was carried out by tools of organic materials; or (c) as suggested above, unmodified edges and natural breaks on blades took over the function of retouched scraper fronts.

Leaving out core-axes, only a few retouched tools displayed traces of wood polish, and the proportion of wood working blades is fairly modest. One of us (HJJ) would like to suggest that the proportional frequency of wood working activities may constitute one means of assessing relative duration of occupancy of a site. Unlike antler or hide, wood is a fairly "neutral" material in terms of seasonality. Wood working is carried out at all times of the year and wooden artefacts constantly need repairing. Furthermore, experiments as well as ethno-

archaeological observations have shown that the working of wood is very flint consuming (Allchin 1957, Crabtree and Davis 1968, Hayden 1978). Consequently the importance of wood working *relative* to other activities carried out at a site will tend to be over-emphasized when estimated solely on the basis of the numbers of tools employed in the tasks. This tendency towards an over-representation is further amplified by the technical fact that wood polish is one of the clearer and more easily recognisable polishes. On the basis of these considerations the low percentage of wood working tools discovered at Vænget Nord may be taken to indicate that occupations were brief and specialised in nature.

ACTIVITY AREAS AND FUTURE RESEARCH

The sampling procedures chosen for this particular study are not very useful for identifying activity areas, and consequently this kind of information is limited. However, on the basis of present results *some* internal organisation can be surmised, although further documentation is needed. Thus, the analysis seem to indicate that the site is divided into two major zones (fig. 10):

(A) Bone/antler working tools are mainly associated with the many features at the southwestern slope of the holm.

(B) Hide working implements are localised in an area with few features at the top of the holm.

Given that this zonation is real and not just an artefact of sampling procedures, it presents some interesting information about the site. For one thing, the presence of a central area – associated with hearths – where minor crafts are carried out, and a peripheral zone where space demanding and dirty work, like the processing of hides, takes place corresponds nicely to the structures observed in ethno-archaeological contexts (Yellen 1977). A second important implication is that "survival" of these kinds of patterns within a site suggests that the cultural material does not constitute meaningless palimpsests of residues from a series of totally unrelated occupational episodes (Brinch Petersen in press).

Current work is concentrating on further investigation of these distributional aspects of the tool functions at Vænget Nord.

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